

Serial Nr.: 10/829,115
Art Unit: 2811

04147-UPL

AMENDMENTS TO THE SPECIFICATION:

Page 4, amend paragraph [0009] as:

[0009] The second protection layer of the present invention is to serve the purposes of protecting the first substrate and grounding. The protection layer, manufactured using a photo-lithography process, is located outside ~~[[of]]~~ the metal bonding pads. The second protection layer includes a polymer layer and a metal layer, and can be connected to the stopper or independently distributed. The ~~thickness~~ height of the second protection layer is ~~[[lower]]~~ smaller than the ~~respective thicknesses~~ heights of the stopper and the compliant bump. The area of distribution of the stopper can range from 0.1% to 99% of the entire first substrate area. In other words, the stopper can substantially or partially cover the entire first substrate.

Pages 4-5, amend paragraph [0010] as:

[0010] The compliant bump and the stopper are both manufactured using a photo-lithography process. There can be many choices for the shapes and dimensions of the compliant bump and the stopper and their distribution of the first substrate surface. The choice depends on the pressure of the facility, the polymer material, the type of the first substrate and the second substrate. The ~~height~~ thickness of the stopper is larger higher than that of the second protection layer, and is different from the ~~thickness~~ height of the compliant bump. The surfaces of the compliant bump and the stopper may contain convexes and concaves, instead of being smooth. The bonding structure and the first substrate together form a component. The bonding film used to bond this component and

Serial Nr.: 10/829,115
Art Unit: 2811

04147-UPL

the second substrate can be ACF, NCF or non-conductive glue. And the methods to bond the bonding film [[is]] are thermal consolidation, thermal compressing consolidation, UV consolidation, or ultrasonic consolidation, or a combination of any of the above methods.

Page 7, amend paragraph [0016] as:

[0016] FIG. 5A shows a preferred embodiment of the bonding structure with compliant bumps containing stoppers. In this embodiment, a first substrate 101 has a plurality of metal bonding pads 105 and is covered with a first protection layer 102. Metal bonding pads 105 serve as the conductive channel to first substrate 101. A metal layer 511 located on first protection layer 102 is connected to polymer bumps and first protection layer 102 or bonding pads 105. Conic bumps 510 are made of polyimide and [[forms]] form a stopper 512 together with metal layer 511. Polyimide is a polymer material with high mechanical strength and high chemical resistance. Each compliant bump 513, located on bonding pads 105 for electrical conduction, includes metal layer 511, conic bump 510, and conductive layer 309. Conductive layer 309 covers the entire topmost layer of compliant bumps 513. In this embodiment, the bonding structure includes two compliant bumps 513 at the center and two stoppers 512 on both sides. NCF 206 is located between first substrate 101 and second substrate 108, and can be melted by heat or UV with pressure in order to bond first substrate 101 and second substrate 108, as shown in FIG. 5B. Metal bonding pads 105, metal layer 511 conductive layer 309 and electrode 103 form a conductive channel.

Pages 7-8, amend paragraph [0017] as:

Serial Nr.: 10/829,115
Art Unit: 2811

04147-UPL

[0017] Both the stoppers and the compliant bumps are conic in FIG. 5A. In accordance with the present invention, the stoppers and the compliant bumps can have different shapes. As shown in FIG. 6A, the two stoppers 612A on both sides of the first substrate are made of metal layer 511 and trapezoid bumps 610A. The compliant bump 613A on the inner side of the first substrate is made of metal layer 511, conic bump 610B and conductive layer 309. The monolithic bumps should have stronger mechanical strength. The size of the bonding area depends on the size of the bump top area. The more pressure the bonding needs, the more difficult to perform the bonding. Therefore, to achieve the sufficient mechanical strength and ease of bonding, the convex-concave surface structure of the compliant bumps can be adopted, as shown in FIG. 6B. Stopper 612B is made of metal layer 511 and trapezoid bump 610C. Compliant bump 613B is made of metal layer 511, the convex-concave-surfaced trapezoid bump 610D and conductive layer 309. Compared to the smooth-surfaced bump, the convex-concave-surfaced bump has a smaller contact surface with electrode 103 of second substrate 108. Therefore, only a smaller pressure is required to perform the bonding. For two bumps with the identical volume and identical mechanical strength, the one with a convex-concave surface requires a smaller pressure to bond than the one with a smooth surface.

Pages 8-9, amend paragraph [0018] as:

[0018] FIG. 6C shows a cross-sectional view of another convex-concave-surfaced compliant bumps. The compliant bumps and the stoppers of this structure have a smaller volume but are more densely distributed. The top of metal bonding pads 105 is distributed with a plurality of trapezoidal bumps 610F. Stopper 612C is made of metal

Serial Nr.: 10/829,115
Art Unit: 2811

04147-UPL

layer 511 and a plurality of trapezoidal bumps 610E. Compliant bump 613C is made of metal layer 511 and a plurality of trapezoidal bumps 610F and conductive layer 309. FIG. 6D shows a similar structure to the structure in FIG. 6C, but the bumps in FIG. 6D has the shape of a round column. The top of a round column is a hemisphere. Stopper 612D is made of metal layer 511, a plurality of round column bumps 610G. Compliant bump 613D is made of metal layer 511, a plurality of round column bumps 610H and conductive layer 309.

Page 9, amend paragraph [0019] as:

[0019] FIG. 7A shows a second protection layer 715 and stopper 712 of the present invention. Second protection layer 715 is manufactured using a photo-lithography process during the manufacturing of stopper 712 and compliant bump 713. Second protection layer 715 is made of metal layer 511 and polymer layer 714. Polymer layer 714, on top of metal layer 511, uses the same material as trapezoid bumps 710. Stoppers 712, made of trapezoid bump 710 and metal layer 511, are on both sides of second protection layer 715. Compliant bumps 713 are on the two ends of first substrate 101. Second protection layer 715 is to protect first substrate 101 from damaging during the bonding of first substrate 101 and second substrate 108 and also to provide grounding. FIG. 7B shows second protection layer 715 and stopper 712 are connected together. The thickness height of second protection layer 715 must be smaller than the respective thicknesses lower than the heights of stopper 712 and compliant bump 713.

Page 12, amend paragraph [0027] as:

Serial Nr.: 10/829,115
Art Unit: 2811

04147-UPL

[0027] FIG. 11D shows a top view of a fourth embodiment of a rectangular compliant bump 1013. Rectangular compliant bump 1113D has four skewed parallel rows of spheres 1115, and the stripe stopper 1112 is distributed on one end, inside the compliant bump 1113D. The spheres 1115 at the other end without the stripe stopper 1112 are only half covered with conductive layer 309. Conductive layer 309 does not cover the stopper 1112. [[.]]